ESO 208

AN ANALYSIS OF STUDENT ATTITUDES AND PERFORMANCES IN THE USE OF COMPUTER ASSISTED INSTRUCTION FOR TEACHING PRODUCTION ECONOMICS

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The use of Computer Assisted Instruction (CAI) for supplementing the traditional classroom and textbook presentations of production economic principles and the related cost concepts was evaluated. The study indicates that the use of CAI is an effective supplemental instrument that enhances the learning process of students.

The introductory course in Agricultural Economics at The Ohio State University introduces the student to basic economic principles. It is a required course for most of the students in the College of Agriculture and in the School of Natural Resources, being taken during the student's freshman or sophomore year. The course is taught in sections of approximately 75 students, meeting five days per week with the same instructor. The approximate annual enrollment is 1000 students.

An important segment of the course deals with production principles and the related cost concepts. These concepts are difficult for many of our students to master. Many students, therefore, need a supplement to the text and classroom discussions to adequately grasp the material in the alloted time.

After consideration of a number of alternative methods, Computer Assisted Instruction was selected as the method for providing supplemental

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teaching of production principles. CAI met a number of important criteria: 1) It could provide realistic problem situations that reinforced the learning process; 2) It provided the opportunity for the student to schedule his own learning experience; 3) It permitted the student to proceed through the material at his own pace; 4) It provided comparable treatment of subject matter topics in a multisection course; 5) The programs could be authored by the instructors themselves; 6) The programs and language were very flexible allowing personalized interaction; 7) It provided extensive record keeping and evaluative capabilities; and, 8) It provided a review tool for students enrolled in advanced courses in agricultural economics.

The CAI Program

The instructional material includes four major segments on the basic production principles and the related short run cost concepts. While these segments are logically sequential, each one is self-contained and may be taken independently of the others.

Following each learning experience, the student is questioned to learn if the concept was comprehended. Each answer is compared with known correct answers, anticipated wrong answers and unanticipated answers.

With a correct response from the student, the program branches into the next unit of the CAI materials. For an anticipated wrong answer or unanticipated answer, however, additional tutoring or explanation is provided. This amplification of the topic allows additional exposure to the material.

The interface between the student and the computer is a teletypewriter terminal. However, the degree of typing skill required of a student is minimal as his answers are usually single words or numbers. The student may keep the typed copy of the questions and his answers for review.

Student Reaction

A study was conducted to evaluate student attitudes toward this program during the spring quarter of 1971. The primary objective of this study was to analyze student reactions and attitude changes brought about by exposure to the CAI materials developed for the course. The participating class consisted of 59 students; 53 males and 6 females.

In order that student reactions to the use of CAI could be analyzed, an attitude test was administered to the sample prior to and immediately following CAI exposure. Responses on a five point scale to the attitude statements after CAI exposure generally exhibited attitudes that were interpreted to be more favorable toward auto-tutorial instruction. Twelve of the eighteen statements showed a significant change in attitude at the 95% level or above (see Table 1).

The results in Table 1 show that the most significant difference in the means of pre-CAI and post-CAI responses occurred in attitude statement 11, dealing with the ability of auto-tutorial instruction to provide adequate individual attention. Comparison of the responses showed that thirty of the fifty-nine students in the sample had shifted toward agreement that auto-tutorial instruction does provide adequate individual attention after exposure to CAI.

Table 1. ATTITUDE STATEMENTS AND MEAN RESPONSES BEFORE AND AFTER CAI WITH T-VALUES FOR DIFFERENCE IN MEANS

	Attitude Statement	Mean Before CAI	Mean After CAI	T-Value
1.	I prefer the standard (conventional) form of education to auto-tutorial instruction.	2.186	2.831	3.564**
2.	Auto-tutorial instruction helps the student conceptualize concepts better than lectures.	2.610	3.305	4.064**
3.	Being able to ask questions in class is important.	1.542	1.407	1.262
4.	I like the freedom auto-tutorial instruction provides.	3.508	3.898	2.280*
5.	Most students would use auto-tutorial facilities much more if they were located in convenient places.	2.203	1.898	2.280*
6.	I like being able to go to an auto-tutorial facility at my convenience rather than being required to go to a scheduled class.	3.729	3.627	.551
7.	The use of auto-tutorial instruction is of little help to me since I cannot ask questions as I go.	2.780	3.576	4.851**
8.	Auto-tutorial instruction is better than teacher contact in learning routine concepts.	2.610	2.525	.478
9.	I can learn more by studying my notes and reading the text than by going to a listening booth or some other auto-tutorial facility.	2.831	3.610	4.896**
10.	I would like to be able to go to an auto-tutorial facility to learn basic information for my courses.	3.593	3.808	2.736**
11.	Auto-tutorial instruction does not provide adequate individual attention.	2.339	3.169	5.287**
12.	I would like to be able to go to an auto-tutorial facility to review basic information for my courses.	3.950	4.220	2.109*
13.	Auto-tutorial instruction is probably a waste of my time.	3.610	4.237	4.673**
14.	Computers provide many useful services for our society.	4.237	4.458	1.714
15.	Computers are too complex to be useful to me.	3.644	4.136	4.473**
16.	I would like to take a course in computer programming.	3.085	3.169	.500
17.	The computer diminishes the importance of the individual in our society.	3.102	3.[illegible]	2.178*
18.	Computers perform many routine tasks in our technological age.	4.136	4.271	1.227

** Significant at 99% probability level.
* Significant at 95% probability level.

After CAI exposure, only two students agreed with statement 13 indicating they felt auto-tutorial instruction was probably a waste of their time. After CAI exposure, thirty-three students responded that auto-tutorial instruction was a better use of their time than they had previously thought.

Statements 1, 2, and 9 compared auto-tutorial methods to standard or conventional forms of education. Responses to these statements after CAI exposure showed that the students still exhibited a preference toward conventional methods, but they were significantly more favorable toward auto-tutorial techniques.

Responses to statements 4 and 5 showed that the students agreed that they liked the freedom of auto-tutorial instruction and that most students would use auto-tutorial facilities much more if they were located in convenient places. They further agreed in statements 10 and 12 that they would like being able to go to an auto-tutorial facility both to learn and to review basic information for their courses. Also, the students were slightly less willing to agree that a) they liked being able to go to an auto-tutorial facility at their convenience rather than being required to go to a scheduled class or b) auto-tutorial instruction was better than teacher contact in learning routine concepts.

Responses to the attitude statements after CAI exposure generally exhibited attitudes that were interpreted to be more favorable toward auto-tutorial instruction. Analyzing these changes in attitude in terms of the face validity of the items suggested that CAI was a useful experience for the students.

Student Performance

A major concern with CAI was the degree to which it assisted students in the learning process. It was hypothesized that students utilizing CAI materials would have a better understanding of the material than students not having access to these materials. Examination scores were used as the measure of evaluation.

The four sections of the Agricultural Economics 100 course taught during winter quarter, 1973, were divided into two control and two treatment groups (Table 2). Each section contained approximately the same number of students.

The sequence of the control and treatment sections were reversed for each of the two instructors to eliminate any carry-over effect from one section to another. The classroom format was further standardized by using a common course outline and a coordinated set of lecture notes. A conscious effort was made by each instructor to offer an "identical course" between instructors and between assigned control and treatment sections.

Higher midterm test scores were achieved in the sections of the course utilizing CAI. The two sections not utilizing CAI had a mean test score of 60.6 (from a possible total of 84 points), while the two sections utilizing CAI had a mean test score of 64.9. This treatment difference was significant at the 1 percent level (Table 3).

Test scores were also evaluated to determine if a statistical difference existed between instructors. The mean scores for Instructors A and B were 61.8 and 63.5, respectively. This interaction effect was insignificant and

Table 2. EXPERIMENTAL DESIGN FOR EVALUATING EFFECTIVENESS OF CAI, The Ohio State University, 1973

Time of Class	Instructor	Treatment
9 a.m.	A	No CAI (Control)
10 a.m.	B	CAI (Treatment)
11 a.m.	A	CAI (Treatment)
2 p.m.	B	No CAI (Control)

Table 3. STUDENT PERFORMANCE AND INSTRUCTOR DIFFERENCES FOR CONTROL AND TREATMENT SECTIONS OF AGRICULTURAL ECONOMICS 100, The Ohio State University, 1973

Instructor		CAI	No CAI	Instructor Total	Instructor $\bar{X}$	
A	Class Size	51	66	117	61.8	
	Time	11 a.m.	9 a.m.			$F_1, 261 = 1.05$
B	Class Size	83	65	148	63.5	
	Time	10 a.m.	2 p.m.			
Treatment Total		134	131	265		
	$\bar{X}$	64.9	60.6		62.8	

$F_1, 261 = 6.76$

indicates that the treatment effect existed independent of instructors. Hence, the students had a similar learning experience from each of the instructors.

Summary and Conclusions

The evaluation of student attitudes toward CAI revealed favorable student acceptance to this type of supplemental teaching method. Student performance measured by exam scores was higher for sections of the course utilizing the CAI materials. Because of these results, the program continues to be regularly used in the course and additional materials are being developed for this teaching method.

Bibliography

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